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ABSTRACT

Internet information resources are proliferating at an astonishing rate, however, very little of that information is of high quality. Educators are in need of instruments to assist in evaluating information quality, which is the goal of a project underway at The University of Georgia. This paper is a progress report on the project to develop such a set of criteria and standards. Indicators of information and web site quality were identified, classified within eleven criterion categories, and rated in terms of importance by a panel of experts on Internet resources. Criterion categories used were: (1) site access and usability; (2) resource identification and documentation; (3) author identification; (4) authority of author; (5) information structure and design; (6) relevance and scope of content; (7) validity of content; (8) accuracy and balance of content; (9) navigation within document; (10) quality of the links; and (11) aesthetic and affective aspects. The highest rated indicators of information quality will provide the framework for a set of instruments and procedures for the evaluation of Internet information resources. Along with the information quality indicators, highly rated indicators of site quality are used to provide design guidelines for the developers of Internet information resources. (Author/SWC)

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Evaluating the Quality of Internet Information Sources

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Abstract: Internet information sources are proliferating at an astonishing rate, however much of that information is of dubious or unknown quality. Educators are in need of instruments to assist in evaluating information quality, which is the goal of a project underway at The University of Georgia. Indicators of information and web site quality have been identified, classified within eleven criterion categories, and rated in terms of importance by a panel of experts on Internet resources. The highest rated indicators of information quality will provide the framework for a set of instruments and procedures for the evaluation of Internet information resources. Along with the information quality indicators, highly rated indicators of site quality will be used to provide design guidelines for the developers of Internet information resources.

Introduction

Internet resources, in particular World Wide Web resources, continue to proliferate at an astonishing rate. A great deal of information is posted to the world every day, but unfortunately very little is of high quality. Unlike professional journals and commercial publishers, who employ a system of editorial review and external referees to ensure the caliber of materials distributed, information can be spread over the Internet by anyone without regard to accuracy, validity, or bias. Due to its global structure, which encompasses a variety of legal systems and cultures, it is unlikely any one individual or nation will be able to significantly influence, regulate, or change the chaotic state of flux that characterizes the World Wide Web. As indicated by a content analysis conducted by (Debashis 1995), much of the material posted on the Internet is self-promotional or commercial (21.9% public relations and 20.7% advertising).

The low quality level and the need to carefully evaluate electronic information has been alluded to by several authors (Descy 1997) (Fitzgerald 1997). Some groups claim to be rating the "quality" of Internet information (e.g., Point Communications' Top 5% of the Web, and Magellan's Star Ratings Systems). Typically, these focus on such indicators of "quality" as how "fun" or "entertaining" a web site appears to be, rather than the instructional value or validity of the content within that site. A need exists for criteria and procedures that will assist students, teachers, and other users in evaluating the quality of Internet information and for standards to guide the design of web resources. This paper is a progress report on a project that was established to develop such a set of criteria and standards. The project is being conducted in six phases, as described below:

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Phase One: Identification of Possible Criteria

Phase one dealt with the identification of possible criteria that could be used to evaluate the quality of Internet information. A number of sources were consulted to extract this information. Among these were (1) compilers of highly rated resource lists, (2) periodicals, journals, and published indexes dealing with Internet resources, (3) on-line rating services, and (4) authorities on library reference materials and processes.

The most valuable sources of information were compilers of Internet resource lists. Individuals or groups that actively maintain listings of Internet resources on a variety of topics (e.g, engineering, science education, cooking) were identified from the listing maintained by The University of Michigan's (Clearinghouse for Subject-Oriented Internet Resource Guides 1996), now the Argus Clearinghouse, which evaluates Internet resource lists. The compilers of lists, which were given high marks for resource evaluation by the Clearinghouse and which were being actively maintained, were contacted via e-mail and asked to describe the criteria they used for selecting resources. Of 43 compilers contacted, 36 responded to the e-mail, and 24 provided selection criteria. A total of 147 suggested criteria or quality indicators were provided by the list compilers.

To identify further criteria of information quality, we consulted a variety of periodicals, journals, and published indices that suggested or rated Internet resources, including *Wired*, *NetGuide*, *The Internet Yellow Pages*, and *The Net*. In addition, the web sites of on-line rating services that provided evaluations of Internet sites were consulted. Typically, these publications and groups did not list selection criteria for the resources they chose to highlight. Those that stated any criteria at all typically focused on vague characteristics of resources such as "well executed," "hip," or "innovative." Such criteria have little to do with the information quality of a resource. Criteria such as "purpose," "coverage," "currency," and "accuracy" are better suited to select and recommend Internet resources. Such criteria provide a standard by which to measure the information quality of an Internet resource. Criteria of this type were more commonly located within the literature on library reference source evaluation (Katz 1992) (Bopp & Smith 1991) and the literature on instructional/web site design than from popular press Internet magazines and on-line rating services. Using such sources, an additional 362 items were identified to produce a total listing of 509 possible criteria or indicators of quality.

Phase Two: Editing and Consolidation of Criteria

Phase two dealt with the editing and consolidation of criteria. A content analysis was conducted on the 509 original items to eliminate duplicate items and clarify those with ambiguous meaning. Any items that were meaningless or which could not be operationally defined, such as "I pick the good stuff," were eliminated. Through this process, the original listing was reduced to a total of 125 indicators of resource quality. The 125 indicators were categorized under eleven major criteria. The major criteria along with the number of indicators within each of the criteria categories are listed below in Table One. Definitions of the criteria as well as a complete listing of the 125 indicators of quality have been published in the May/June, 1997, issue of *Educational Technology* (Wilkinson, Bennett & Oliver 1997).

Phase Three: Evaluation of Consolidated Criteria

Some of the indicators identified in phase two seemed to deal more with aspects of the web site than with the quality of the information provided by the web site. Also, 125 indicators were too many to be of practical use by resource evaluators. Therefore, phase three of the project sought to use the opinions of experienced Internet resource users to identify the focus and assign a rating of importance to each of the indicators. Of the 36 compilers of highly rated resource lists responding to our call for evaluation criteria, 30 had agreed to serve on a panel to rate the criteria that were developed. Since the Argus Clearinghouse continually evaluates lists and adds new resource lists to its on-line database, we were able to identify an additional 61 compilers of Internet resource lists that were highly rated on resource evaluation. These individuals, along with 13 compilers who had not responded to the initial invitation, were invited to join the review panel for phase three of the project. Of these, 34 agreed to join the panel, creating a total of 64 compilers who agreed to review the list of quality indicators.

A questionnaire was developed that asked panel members to identify whether each of the 125 items was an indicator of information quality, an indicator of web site quality, or an indicator of both and to rate the importance of each criteria on a six point scale ranging from irrelevant (1) to essential (6). The panel was also encouraged to provide comments and suggestions related to the criteria categories as well as the individual indicators. To collect this information, two versions of the questionnaire were created--one web-based and the other on paper. Copies of these instruments are available for examination through the project's web site (Wilkinson, Oliver & Bennett 1997). 34 of the panel members were mailed paper copies of the questionnaire along with pre-paid return envelopes and the remaining 30 members were mailed letters inviting them to link onto the web-based questionnaire. One month after the initial mailing, the panel members who had not responded were contacted by e-mail and offered the alternative versions of the questionnaire.

Of the 64 panel members who had agreed to participate in phase three, 49 completed the questionnaire for an overall return rate of 76.56%. 28 paper questionnaires (82.35%) were completed and returned while 21 panel members (69.9%) completed the web-based questionnaire. The lower return rate for the web-based questionnaire, despite the perceived ease of using such forms and the Internet access and familiarity of the panel members is an interesting question for further research. Demographics of the responding panel members include the following: 75% male, 25% female; equally dispersed in age from 18-58; 73% work within higher education, 13% in business/industry, with just a few in government or k-12 school setting; and 40% were specialists in the library and information science field, 36% in an academic subject field, and 13.3% came from computer science/technology.

Although each of the indicators was felt to deal with some aspect of the quality of the Internet resources that were located, some of them dealt with the information while others appeared to deal more with the quality of the site or the experience of using the site. Responses to the first question following each indicator were used to classify the indicator as dealing primarily with the site, the information within the site, or with both site and information. If fifty percent or more of the panelists indicated that the item either dealt with site or with both site and information, it was classified as an indicator of site quality. If a similar percentage felt the item dealt with information or both site and information, it was classified as an indicator of information quality. As a result, a total of 45 of the 125 indicators were categorized as dealing with both site and information quality. The other 80 indicators were divided between site and information to produce the distribution within criterion categories as shown in Table One below. As can be seen in Table One, a few of the criteria categories, such as "Site Access and Usability" and "Aesthetic and Affective Aspects," deal primarily with the quality of the web site while a number of the other criteria categories deal entirely with the quality of the information within the site.

	Number of Indicators		
Total		**Site**	**Information**
Criterion 1: Site Access and Usability	18	18	2
Criterion 2: Resource Identification and Documentation	13	4	13
Criterion 3: Author Identification	9	3	9
Criterion 4: Authority of Author	5	–	5
Criterion 5: Information Structure and Design	19	13	19
Criterion 6: Relevance and Scope of Content	6	–	6
Criterion 7: Validity of Content	9	–	9
Criterion 8: Accuracy and Balance of Content	8	–	8
Criterion 9: Navigation within Document	12	12	8
Criterion 10: Quality of the Links	13	10	12
Criterion 11: Aesthetic and Affective Aspects	13	13	6
TOTAL	**125**	**73**	**97**

Table 1. Classification of Indicators by Criterion Category

In addition to indicating the focus of each of the quality indicators, the panelists were asked to rate the importance of the indicator on a six point scale so that the more important items could be identified for inclusion in the evaluation instruments. Because individuals might be ranking items differently depending on whether they were thinking of the item as dealing with the site or with the information within the site, a mean value was computed for those who felt the item dealt with information quality and a different mean value was computed for those who felt the item dealt with site quality. The rank and mean value assigned to each indicator for information quality (those rated as important or essential) is presented in Table Two below. Values for site quality are presented in Table Three. The effects of classifying the indicators on the basis of the percentage of panelists who regard the item as dealing with site or information is born out by the fact that eight of the nine highest rated site indicators was dropped from the final list when the criteria was set at 50 percent for inclusion in the ranked listing. Using a 50 percent cut off, the total number of information quality indicators was 71 and total of site quality indicators was 67.

Rank	Mean	Indicator	
1	5.60	**9.1**	Is there a good organizational scheme (e.g., by subject, format, audience, chronology, geography, authors, etc.)?
2	5.37	**6.2**	Is the information sufficiently current to meet the user's needs?
3	5.35	**8.1**	Are there any obvious errors or misleading omissions in the document?
4	5.33	**10.10**	Are the links relevant and appropriate to the document?
5	5.32	**3.1**	What is the author's name?
6	5.29	**3.2**	What is the author's professional or institutional affiliation?
7	5.28	**8.5**	Does the author or the sponsor of the site have a vested or commercial interest in the topic?
8	5.27	**10.8**	Are the links evaluated in any way prior to inclusion?
9	5.19	**2.10**	When was the document last revised?
10	5.15	**2.1**	What is the title of the document?
11	5.09	**2.2**	Within what major fields, disciplines, or topics does the document fall?
12	5.07	**5.5**	Does the content fit the stated scope, purpose, and audience?
13	5.05	**6.1**	Is the content related to the user's needs?
14	5.03	**5.1**	Is the scope of the document clearly stated?
15	5.02	**4.1**	Is the author a recognized authority on the topic of the document?
16	5.00	**8.3**	If the document deals with controversial issues, is the bias of the author clearly identified?
	5.00	**7.6**	Does the author provide a bibliography or cite references to confirm the accuracy of the information?
18	4.97	**5.3**	Is the title of the document descriptive of its content?
19	4.93	**8.4**	Is the site sponsored or cosponsored by an individual or group that has an established position regarding the issues discussed in the document?
20	4.91	**2.5**	Is there a description of the document's content?
	4.91	**5.6**	Does the use of graphics and icons contribute to the clarity and usability of the information?
22	4.90	**2.3**	For what audience was the document designed?
23	4.89	**1.2**	What individual, group, or organization sponsors and/or maintains the site?
24	4.88	**2.4**	What is the mission, purpose, or scope of the document?
	4.88	**10.9**	What are the link selection criteria, if any?
26	4.85	**6.5**	Are there any obvious gaps or omissions in the coverage of the topic?
	4.85	**9.2**	Is there provision for topic narrowing via conventions such as menus that follow the organizational scheme?
	4.85	**5.4**	Does the content fit the stated scope, purpose, and audience?
29	4.82	**3.4**	What is the author's training or experience with the topic?
30	4.76	**8.7**	Is the information presented in the document of a consistent quality?
		6.3	Is the coverage of the topic sufficiently broad to meet the user's needs?
32	4.74	**4.5**	Is the author affiliated with an educational institution, research laboratory, governmental agency, or other reputable organization related to the topic of the document?
	4.74	**2.7**	When was the document created?
34	4.70	**3.9**	Was the development of the document funded or otherwise supported by an individual, group, or organization other than the identified author?
	4.70	**4.4**	Is the author's experience appropriate and related to the topic of the document?
	4.70	**7.7**	Does the author provide verifiable statistics to support conclusions?

Table 2. Highest Rated Indicators of Information Quality

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Rank	Mean	Indicator	
1	5.60	**9.1**	Is there a good organizational scheme (e.g., by subject, format, audience, chronology, geography, authors, etc.)?
2	5.34	**11.9**	Is the design so complex that it detracts from the content?
3	5.22	**11.3**	Are readability and legibility guidelines followed (e.g., sufficient color and tone contrast between text and background, font size, doesn't use all caps, etc.)?
4	5.05	**10.1**	Are the links clearly visible and understandable?
5	4.97	**9.7**	Is there a consistent sense of context or understanding of position within the document at any given time?
6	4.94	**5.6**	Does the use of graphics and icons contribute to the clarity and usability of the information?
7	4.91	**2.13**	What is the URL of the document?
8	4.88	**10.13**	How reliable are the links (are there inactive links or references to sites that have moved)?
	4.88	**1.2**	What individual, group, or organization sponsors and/or maintains the site?
10	4.85	**1.12**	Is it a commercial site that requires payment for full access?
11	4.81	**9.5**	Is there a table of contents that can be used to navigate within the document?
12	4.80	**9.4**	Is there an index that can be used to navigate within the document?
13	4.79	**9.2**	Is there provision for topic narrowing via conventions such as menus that follow the organizational scheme?
	4.79	**10.2**	Do essential instructions appear before links and other interactive portions?
15	4.77	**2.12**	If the resource is to be removed, does the site state where it will be available?
16	4.75	**11.1**	Does the document follow accepted graphic design principles (e.g., balance, unity, proportion, simplicity, etc.)?
17	4.73	**1.13**	If commercial, is the price specified up-front?
	4.73	**1.1**	What is the name of the site?
19	4.72	**11.5**	Do the creative elements enhance the usability and appeal of the document?
20	4.68	**1.10**	Is it usually possible to reach the site, or is it frequently overloaded or shut down?
21	4.65	**1.17**	If involving confidential information, are interactions secured?
	4.65	**11.2**	Does the document follow accepted text design principles (e.g., appropriate use of headers, limited mix of type styles and sizes, etc.)?
23	4.64	**10.4**	Are links annotated?
24	4.63	**11.8**	Does the interface make use of consistent menu conventions from screen to screen (e.g., terminology, icons, positioning on page, etc.)?
25	4.58	**9.8**	If linking to another page, is there a way to get back to the home page?
	4.58	**10.5**	Are users informed of the type of file they are linking to (e.g., video, sound, etc.)?
27	4.56	**2.6**	Is the user informed of improper or controversial materials (e.g., adult language, sexually explicit material, gratuitous violence, etc.) within the document?
28	4.52	**5.8**	Does the site offer a variety of features in addition to delivering content (e.g., provides e-mail links for further information, downloads, ordering, discussion lists)?
29	4.50	**1.7**	Is the document source code free of bugs and breaks?
30	4.49	**9.9**	Is it easy to locate a particular page from any other page?

Table 3. Highest Rated Indicators of Site Quality

Phase Four: Development of Evaluation Instruments and Procedures

During the Spring of 1997, the information developed during phase three of the project will be used to develop products in two major areas:

(1) The quality indicators that received marks near "essential" and which were classified as related to information quality will be used as the framework for the development of instruments to evaluate the quality of resources located on the Internet. At the same time, procedures and strategies for effective searching for resources and for the application of the evaluation instruments will be developed.

(2) The criteria that were identified by the panel as being related to site quality and which received high importance ratings will be used to develop a set of guidelines for the development of quality web sites. These guidelines will then be used to develop templates for web site design.

The development of the different products will of necessity require some cross matching of indicator categories. For example, in order to determine the bias of vested interest of sponsoring bodies (information quality items #8 and #23) it will be necessary to identify the sponsor of the site (an item in Criterion 1 that was classified as a site indicator). Also, the web site design guidelines will need to contain the indicators necessary to make judgments about the quality of the information.

Phase Five: Field Testing and Validation

During phase five, the resource evaluation instruments and procedures developed in phase four will undergo a formative evaluation process with a population of undergraduate pre-service teacher training classes at The University of Georgia. These future teachers are representative of young learners that have been underexposed to evaluation and selection processes--especially of the dynamic and varied content accessible through the Internet. They also represent the models for more naive, younger k-12 learners who will depend on them to select quality resources or to scaffold strategic steps in searching for and retrieving on-line information. The final versions of the instruments will then be used by graduate students to assess the quality of representative samples of Internet resources within various subject areas.

Phase Six: Dissemination of Products

Following validation, information about the instruments and procedures will be disseminated by means of journal articles and conference presentations. The actual instruments and procedures will be made available, at no charge, through the project web site at The University of Georgia. Until the instruments have completed field testing, this site will contain continuing updates on the progress of the project.

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